

**Qualifications Based Selection Policy Implications for  
Naval Facilities**

**by**

**GREGORY ALFRED GARCIA, B.S.**

**Thesis**

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

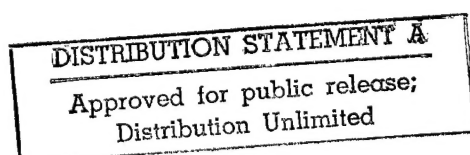
of the Requirements

for the Degree of

**Master of Science in Engineering**

**The University of Texas at Austin**

**December 1996**



19970103 076

Copyright  
by  
Gregory A. Garcia  
1996

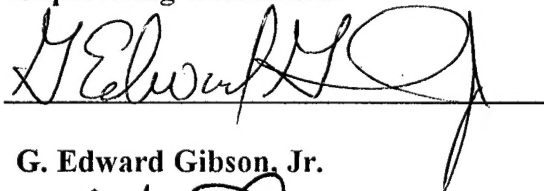
DTIC QUALITY INSPECTED 2

**DISTRIBUTION STATEMENT A**

Approved for public release;  
Distribution Unlimited

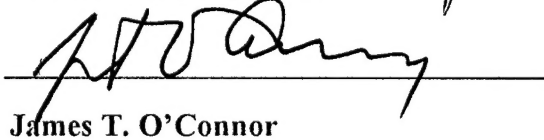
**Qualifications Based Selection Policy Implications for  
Naval Facilities**

**Approved by  
Supervising Committee:**



A handwritten signature in dark ink, appearing to read "G. Gibson", written over a horizontal line.

**G. Edward Gibson, Jr.**



A handwritten signature in dark ink, appearing to read "J. O'Connor", written over a horizontal line.

**James T. O'Connor**

## **Abstract**

### **Qualifications Based Selection Policy Implications for Naval Facilities**

by

**Gregory Alfred Garcia, M.S.E.**

**The University of Texas at Austin, 1996**

**Supervisor: G. Edward Gibson, Jr.**

For years the construction industry has struggled with hiring qualified Architect and Engineering (A/E) firms. The question proposed today is if the benefits derived from going through a long, laborious process worth the added time and money spent? The United States deemed this concept so crucial that the Brooks Act was implemented in 1972. Essentially, the Act mandates that all design work must be awarded based on qualifications of the A/E firms rather than price. In today's construction industry, the private sector has begin to apply some price pressures on A/E firms. This study will focus on comparing the overall success of office building projects that have used purely the qualifications versus projects that have used some price considerations in the selection process of their A/E firms.

## Table of Contents

List of Tables .....	ix
List of Figures .....	xi
Chapter 1: Introduction.....	1
1.1 Purpose .....	1
1.2 Objectives.....	3
1.3 Overview .....	3
Chapter 2: Background .....	4
2.1 Introduction to Navy A/E Contracting .....	4
2.2 Laws, Regulations & Policy .....	9
2.3 Typical NAVFAC Aquisition Process .....	14
2.4 Length of Aquisition Process .....	15
2.5 Background of Phase I Study.....	17
2.6 Objectives of Phase I Study .....	18
2.7 Scope of Phase I Study .....	19
2.8 Methodology of Phase I Study.....	20
Chapter 3: Preliminary Investagation .....	21
3.1 Literature Summary .....	21
3.2 Overview of Statistical Procedures.....	27
3.3 Preliminary Interview Feedback .....	29
Chapter 4 Methodology.....	31
4.1 Hypothesis.....	31
4.2 Methodology .....	31
4.3 Data Gathering Procedures .....	33
4.4 Data Analysis Procedures .....	34

4.5 Data Gathering Tools .....	37
4.6 Service Provider Questionnaire .....	39
Chapter 5 Presentation and Data Analysis .....	40
5.1 Characterization of Sample .....	40
5.2 Characterization of QBS and non-QBS .....	41
5.3 Analysis of Data .....	44
5.4 Design Cost .....	44
5.5 Cost per Square Foot .....	46
5.6 Schedule Analysis .....	47
5.7 Changes Analysis .....	48
5.8 Owner's Subjective Analysis .....	49
5.9 Evaluation of Data Collection Method .....	50
Chapter 6 Conclusions and Policy Implications .....	56
6.1 Conclusions .....	56
6.2 Policy Implications .....	58
APPENDICES .....	59
Appendix A: Project Performance Questionnaire .....	60
Appendix B: Service Acquisition Questionnaire .....	70
Bibliography .....	74
Vita .....	78

## **List of Tables**

Table 1.1:	A/E Selection Methods .....	2
Table 2.1:	Design/Build Advantages .....	5
Table 2.2:	Design Build Disadvantages .....	6
Table 2.3:	NAVFAC A/E Acquisition Process .....	14
Table 2.4:	Priority System .....	16
Table 4.1:	Performance Criteria/Questionnaire Matrix .....	37
Table 5.1:	Sample Characterization .....	41
Table 5.2:	A/E Selection Methods .....	42
Table 5.3:	QBS and non-QBS Characterization .....	43
Table 5.4:	Design Cost .....	45
Table 5.5:	Cost per Square Foot .....	46
Table 5.6:	Schedule Analysis .....	47
Table 5.7:	Changes Analysis .....	48
Table 5.8:	Owner's Subjective Analysis .....	50

**List of Figures**

Figure 2.1: Procurment Options ..... 10

Figure 2.2: Methodology of Phase I Study .....20

Figure 4.1: Methodology .....32



## **Chapter 1: Introduction**

### **1.1 Purpose**

For over 25 years the Government and many in of the private construction industry have been using the Brooks Act, a qualification-based selection (QBS) process, to hire A/E services for construction projects. The consensus from many design professionals is that the quality of a project is directly related to the method in which the firm is selected. Although this feeling is shared by many A/E designers, there has never been any significant data gathered to confirm the benefits of the Brooks Act. The Act was adopted in the 1970's not only by federal agencies but also by all 50 states. Since then three states, Florida, Maryland and Massachusetts, have changed their laws allowing owners to choose design services based on price alone. Maryland has since reverted back to QBS. (Vanden Bosch et al. 1996)

According to the laws in most states, the sole method of contracting with an A/E firms for public projects should be QBS. However, reports from within the construction industry have shown a significant trend that many owners are using price to determine selection of A/E services. This brings up two key questions; What degree of difficulty and how successful are these projects?, and how much did price control the selection of the design services? The Construction Industry Institute has done a preliminary study that set up the framework for an intensive study to be done in this area. (Vanden Bosch et al. 1996)

Among the many issues this study addressed, are the various types of A/E selection methods. From this study, Table 1.1 gives 5 methods of A/E selection. The first three methods are categorized as "price-based" selection and the last two

are QBS. As project data are analyzed using the Questionnaires generated by phase I of the CII investigation, the projects will be separated into the two categories. This will allow a thorough analysis to be conducted on QBS versus non-QBS projects. The final goal using the data obtained from randomly selected projects is to determine whether the QBS process provides any significant impact to the overall success of the projects.

Table 1.1 A/E Selection Methods (Vanden Bosch et al. 1996)

	DESCRIPTION
<b><u>Non-QBS</u></b> <b>Bid</b>	<i>(Price)</i> Price is the only selection determinate.
<b><u>Combination</u></b> <b>Two envelope</b>	<i>(Pre-qualification, Price)</i> The first envelope contains qualifications only. All highly qualified firms are pre-qualified. Pre-qualified firms are invited to submit price proposals. The second envelope contains the price proposal. Award is based on best price.
<b>One envelope</b>	<i>(Best value, considering qualifications and price)</i> Firms simultaneously submit qualifications and price. Award may be based on some combination of price and qualifications.
<b><u>QBS</u></b> <b>Two envelope</b>	The first envelope contains qualifications only. The one best qualified firm is selected and asked to submit a price proposal. Price is negotiated with the one best qualified firm only.
<b>Sole source</b>	<i>(Reputation is the selection determinant)</i> The firm is selected based on their reputation and/or familiarity with client's project. Price may or may not be negotiated.

## 1.2 Objectives

Naval Facilities Command (NAVFAC) spends millions of dollars a year contracting private A/E sources. The Phase I report has discovered a growing

trend in the private sector to consider price more of a factor during the A/E selection process. The primary focus of this study is to determine if there is any benefit to these new selection processes. Is the construction industry saving money and getting the same quality facility? One of NAVFAC's goals is to continually search for better ways to provide support to the Fleet. This study will provide unbiased information and possibly a way for NAVFAC to provide A/E services faster and cheaper to their customers. The four objectives for this study are:

- 1) Firmly establish NAVFAC's position with respect to the Brooks Act.
- 2) Analyze randomly selected project data to determine if QBS versus non-QBS of design service have an impact on final outcome of a construction project.
- 3) Critique the questionnaire developed by CII.
- 4) Outline possible policy implications for NAVFAC based on this study.

### **1.3 Structure of Thesis**

The following chapters will present background information on the Navy's current policy with respect to the Brooks Act and CII's Phase I report which includes a thorough literature review. Once the background has been established, the remaining chapters will include the research methodology, presentation and data analysis of a pilot study, as well as conclusions and policy implications for NAVFAC.

## **Chapter 2 Background**

### **2.1 Introduction to Navy A/E Contracting**

Over the past decade, there has been a move to improve methods in contracting for facility design. The emphasis has been placed on providing better services without compromising quality of design and construction. This concept coupled with the draw down of the military has forced the Government to look at new and innovative methods in the contracting arena. One of the areas under scrutiny is outsourcing of design to A/E firms.

There appears to be a transition phase in effect within NAVFAC with an increased use of Design/Build projects. One study revealed Design/Build projects on child care facilities realized a \$20 per square foot (SF), 75 percent reduction in the number of design changes, and completed the projects 8 months earlier than the typical Design/Bid/Build projects. (Roth 1995) These are significant results, although the study was performed on a small sample of projects. Not only does the owner get the use of the facility earlier at less cost, but also the contracting administration team can focus on other projects. This reinforces the concept of working more efficiently with less work force.

If Design/Build contracting seems so appealing, then why is the transition in using this process occurring at a relatively slow pace? Naval Facilities Engineering Command (NAVFACENGCOM) consists of thousands of people such as engineers, lawyers, contracting officers, contract administrators and inspectors who all play a major role and work in different offices around the world. Not only must thousands of people be trained to administer Design/Build

contracts, but also the legal aspects need to be reviewed so that free and open competition is not compromised. In addition, the advantages and disadvantages must be analyzed to help in determining if Design/Build is a viable long term solution. Tables 2.1 and 2.2 summarize some of the advantages and disadvantages associated with Design/Build contracting. (Roth 1995)

Table 2.1 Design/Build Advantages (Roth 1995)

Area of Impact	Design/Build Advantages
A Time	<ul style="list-style-type: none"> <li>• Use of fast-track concepts allows project to be completed more quickly.</li> <li>• Project can be prepared for solicitation and awarded quickly.</li> <li>• Design/Build has been proven to be 30% faster at delivering the project in some studies.</li> </ul>
Cost	<ul style="list-style-type: none"> <li>• Guaranteed maximum price is established early in the process.</li> <li>• Number of modifications significantly reduced.</li> <li>• In-house staff can be effectively used for IFB development.</li> <li>• Method recognizes the increased importance of the time-value of financing and incorporates fast-track well.</li> <li>• Method enhances the effectiveness and incorporation of TQM, partnering, team-building and fast-tracking concepts.</li> </ul>
Coordination	<ul style="list-style-type: none"> <li>• Single entity responsible for design and construction.</li> <li>• Close coordination inherently required by all parties leads to quick problem resolution.</li> <li>• Close coordination between A/E and Contractor occurs regarding design feasibility and constructability issues.</li> <li>• Design/Build involves Subcontractors earlier in the process obtaining valuable design input.</li> <li>• A/E designs to contractor's strengths facilitating construction .</li> </ul>

Table 2.1 Design/Build Advantages (Cont.) (Roth 1995)

Area of Impact	Design/Build Advantages
Coordination (Cont.)	<ul style="list-style-type: none"> <li>• The new organizational make up within Design/Build organization maximizes the respective talents and experience of all the project players.</li> </ul>
Litigation	<ul style="list-style-type: none"> <li>• Claims and litigation are limited through proper risk allocation and assignment of responsibilities.</li> <li>• Method accommodates multi-parameter bidding schemes which allow for award based on factors other than price.</li> <li>• Contractual relationship between the Owner and Design/Build entity is significantly simplified</li> <li>• Owner is insulated from liability for design errors and omissions. Although the Design/Build contractor assumes responsibility, he is empowered with the ability to manage them directly.</li> </ul>

Table 2.2 Design/Build Disadvantages (Roth 1995)

Area of Impact	Design/Build Disadvantages
Time	<ul style="list-style-type: none"> <li>• Design/Build contracts may take longer to award because of the complexity of the award process.</li> <li>• Design/Build process is more dynamic, requiring increased team and administrative participation.</li> </ul>
Cost	<ul style="list-style-type: none"> <li>• Cost of responding to IFB and developing proposal can be extremely expensive. This tends to limit competition and eliminate small firms.</li> <li>• Bonding costs for A/E and Contractor can be up to 50% higher.</li> <li>• Proposal cost is a sunk-cost, recovered only if contractor is awarded contract.</li> <li>• Modifications made after award can be extremely expensive if not made in a timely manner.</li> <li>• Increased responsibility of the Design/Build Contractor carries increased risk, therefore, he may increase his bid price for contingencies.</li> </ul>

Table 2.2 Design/Build Disadvantages (Cont.) (Roth 1995)

Area of Impact	Design/Build Disadvantages
Coordination	<ul style="list-style-type: none"> <li>• A/E's direct link of communication with owner is removed .</li> <li>• A/E's first allegiance is to the contractor not the owner. A/E's feel their fiduciary role is changed.</li> <li>• Project scope must be defined extremely early in the process.</li> <li>• Process can be a real risk for unsophisticated owners not familiar with their administration .</li> <li>• Knowledgeable in-house staff must closely monitor project.</li> <li>• Importance of selecting an excellent project team is increased.</li> <li>• Inexperienced Subcontractors dislike the uncertainty of the process.</li> </ul>
Legal	<ul style="list-style-type: none"> <li>• Design/Build contracts are prohibited in some states.</li> <li>• Litigation may develop if the scope of work defined in the IFB is not absolutely clear.</li> </ul>

Although the Design/Build topic is very interesting and seems to be gaining momentum as a contracting vehicle, the intent of this study is to focus on the contracting of A/E firms that ultimately provide the drawings and specifications. The purpose of quickly reviewing the Design/Build issue is to show that there is a move in both the private and public sector to stray away from the conventional Design/Bid/Build is occurring. With the construction industry becoming more competitive and international companies entering the U.S. market, owners and construction companies in the private sector are looking for better ways of doing business, or areas that will save money.

Apparently, there are pressures being placed on A/E firms by private owners to consider price as part of the selection method. This is contradictory to the Brooks Act. Has the private industry discovered a way to save money on design costs without impacting the quality of construction? There is probably a yes or no answer. There are various degrees of difficulty of construction projects.

The bottom line is there has never been a valid study to prove or disprove the value of the Brooks Act.

Thirty years ago when there was plenty of military construction dollars, the main focus with respect to A/E firms was not to sacrifice any design quality for the sake of saving a few dollars. Elaborate design aids such as CAD were not widely used. Technology with computers and information flow are now making tremendous advances and allowing many more competitors into the market. With the aid of technology, many simple projects can be reproduced very quickly for a fraction of the previous costs. Engineering is a very specialized skill, but has technology and education allowed the world to take a step up and change the way projects are designed?

Regardless of the situation, the consensus of industry participants is that good design is essential to the success of a project. Not only is it true in the United States but countries such as Japan place a great emphasis in the design phase. A project that is well designed will experience less changes and ultimately give the owner a safer and more maintenance free facility. Since 85 percent of a facility's costs are experienced after the building is completed (Bell et al. 1990), why are some private owners pressuring A/E firms into a price-driven qualification process?

There are many issues and questions that have been raised. The answers are not straight forward, but before attempting to even address the issue, a statistical analysis comparing QBS projects to non-QBS projects should be conducted. Is the quality of some non-QBS designed facilities the same as QBS ones? If so, then the construction industry can probably save millions of dollars



annually. Obviously, projects that are complex in nature and are on the cutting edge of technology will most likely require the best A/E firms. If there is a significant difference between the quality of non-QBS projects and QBS projects, then the Brooks Act needs to be reinforced as the best way to do business.

Before gathering data to prove or disprove the hypothesis, the current laws, regulations and policies need to be reviewed. The ultimate goal of NAVFAC is service to the Naval Fleet through innovative ways of providing better facilities at reduced cost. However, the avenue chosen to give the best service has boundaries, therefore, it is important to examine regulations and processes that are currently being used in NAVFAC.

## **2.2 Laws, Regulations & Policy**

There are basically two procurement options to obtain A/E services within NAVFAC as illustrated in Figure 2.1. Each of these avenues contain eight distinct steps starting with the original procurement strategy to the ultimate award of the contract. Essentially, the A/E services can be obtained by separate design and construction which falls into the traditional method. The second approach is to obtain the A/E services through the Design/Build route. For the purpose of this study, separate design and construction will be the focus. In Design/Build, the design fees and construction costs are included in the eight step process. In the traditional sealed bid approach, the A/E has been chosen and is normally included in the procurement strategy of the construction contract. (GSA 1994)

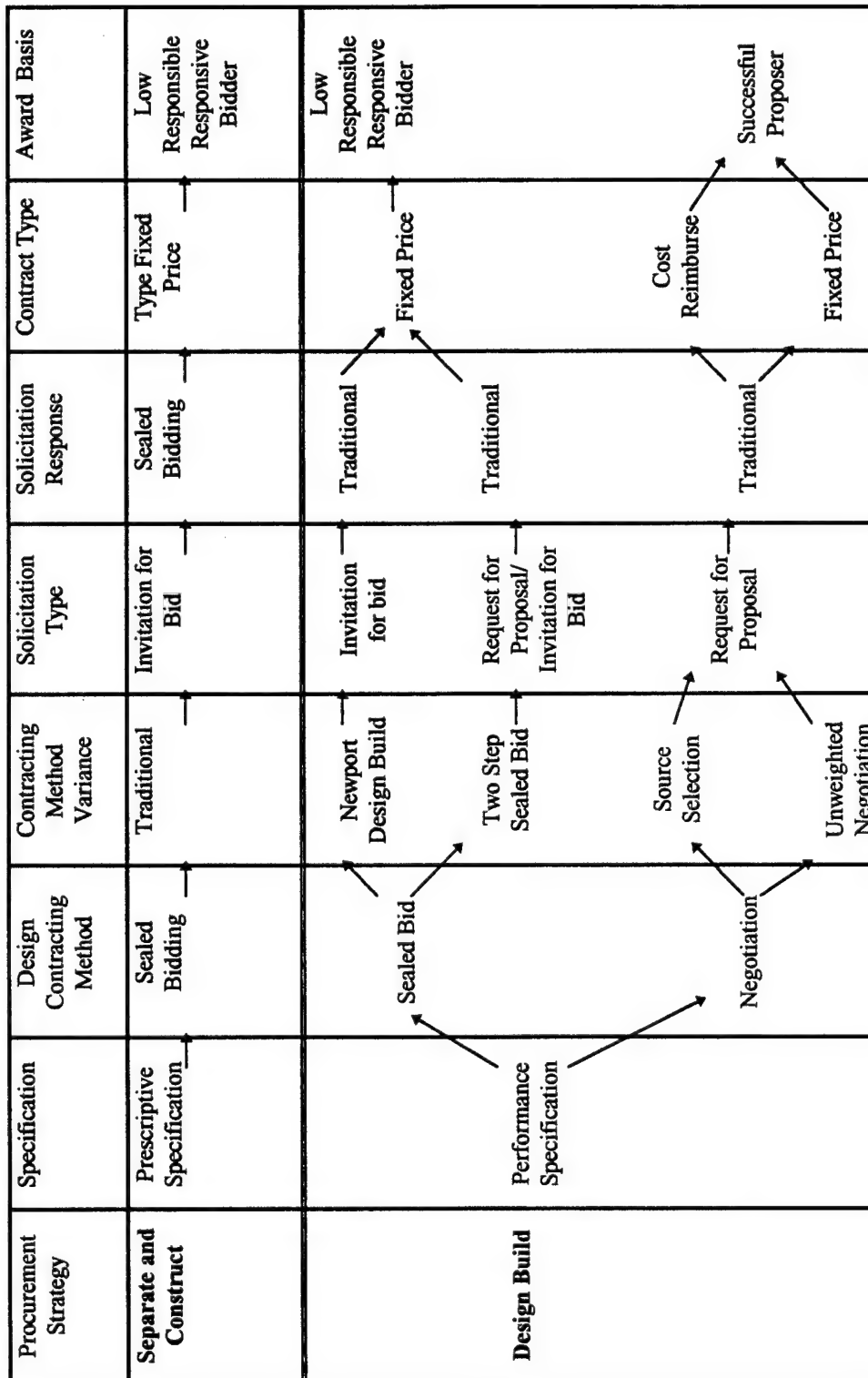


Figure 2.1 Procurement Options

Prior to examining the details of the laws and regulations, a cursory review of the history of the major events leading to the Brooks Act will explain the philosophy or the intent of the act which congress passed in 1972. In 1947 the Armed Services Procurement Act gave the government the authority to contract. Naturally, the government was contracting prior to these dates but this Act gave official direction. Since approximately 1939, A/E services were obtained based on qualifications rather than price. The philosophy is quite simple and clear. When a professional registered skill is required, the most natural approach people take is to attempt to get the most qualified person within reason. Good examples are doctors and lawyers. Architects and engineers generally fall into a similar category, especially with the complex design of buildings, utilities and bridges. Proper design is crucial for the safety to the public.

Based on this premise, A/E services were obtained with that type of philosophy. Essentially, the government was conducting business in this fashion for 30 years. Then in 1967 the Comptroller General recommended that price should be considered in the selection of A/E services and that the six percent limitation on A/E fees should be repealed. In response to the Comptroller's recommendation, H. R. 12807 clarifies procedures for the selection of A/E firms. In summary, the bill kept the current practice of using qualifications for selection, and the six percent limitation fee maintained. (NAVFACCONTRACEN 1996)

The six percent fee refers to the preparation of designs, plans, drawings, and specifications and can be no more than six percent of the estimated construction cost of the project. The six percent fee does not include engineering services such as field investigations. In some cases, especially in the

environmental arena, the cost of engineering services may exceed the cost of performance.

In 1972, the Brooks Act was passed. The law spelled out specific procedures for A/E contracting. Congress declared its policy for the Federal Government to publicly announce all requirements for architectural and engineering services, and to negotiate contracts for architectural and engineering services on the basis of demonstrated competence and qualification for the type of professional services required and at fair and reasonable prices. (Brooks Act 1972) The law is very logical and well thought out. Since engineering is a specialized field, it is prudent to hire the most qualified firm as long as the prices are fair and reasonable. This makes even more sense if an A/E firm is selected to design a complex project such as the launching pad for the space shuttle. Not only is that system very complex, but safety is another concern for the people who will be in the shuttle. That situation is clear cut, i.e. to select the best.

But what about circumstances such as the design of a perimeter fence, a softball field, or an office building? Does it make sense to go through a rigorous selection process to choose the best A/E firm? In the future, will owners be able to purchase off the shelf designs for these types of facilities at low bid. A solid approach to analyzing the situation is to link the method of selection of A/E firms with factors that relate to project success. This is a very objective and unbiased approach.

Over the past 10 years, Congress has been moving towards improving the contracting process. In April 1985, the Competition in Contracting Act was passed which simply amended the Armed Services Procurement Act by

substituting sealed bids for formal advertising and replaced 17 exceptions with seven. The most recent law was passed FASA in 1995. The purpose of the law was to speed up the government's contracting process especially with small A/E contracts. Essentially, this raises the short selection process (SSP) threshold from \$25,000 to \$100,000.

The SSP only requires interviews over the phone with a minimum of 3 firms. There is no longer a 30 day requirement to wait for a response from A/E firms to receive their proposals. The Contracting officer can designate a reasonable period. Additionally, the A/E firms are no longer required to turn in a Standard Form 255. This form describes the A/E's relative experience and provides a formal proposal tailored to a specific project. The only form required is the Standard Form 254 which is the qualifications of the A/E company and only needs to be updated on an annual basis. For A/E services that exceed \$100,000, a Standard Form 255 must be completed on each contract.

For A/E services less than \$100,000, a contract can be awarded in one of two methods. The first method is the Chairman of the pre-approved standing board can select an A/E firm based on a minimum of three phone interviews and a review of the Standard Form 254 submitted or ones that are held on file. Then the Chairman of the Board gives his written recommendation to the Contracting Officer for signature. The other method is a standing board of three members appointed by the Engineering Field Division Commanding Officer who can directly approve the selection of an A/E firm. However, the board must then write a report on why a the A/E firm was selected.

Every field office varies with respect to organizational structure and mission. Obviously, to set one specific guideline to meet all the objectives would essentially be impossible. Therefore, the Department of Defense (DoD) falls into the broad category of the Federal Acquisition Regulations (FAR) and the DoD FAR supplement. These are the primary procurement regulations for the DoD. The Navy Acquisition Procedures Supplement (NAPS) provides additional guidance in the area of Navy contracting. NAVFAC has further defined the guidance to include specific authority, responsibilities and internal procedures. The NAVFAC Publication P-68 is the source of information for the delegation of authorities for the execution and administration of A/E contracts. Finally, the Engineering Field Divisions (EFD) set more refined guidance tailored to the specific organizational needs and goals. (NAVFACCONTRACEN 1996)

### **2.3 Typical NAVFAC Acquisition Process**

FASA has enabled the government to expedite many contract actions. The trend is to provide the services to the customers without jeopardizing competition. Depending on the situation and the amount of A/E contracting, the typical acquisition process for A/E contracts greater than \$100,000 is shown in Table 2.3. (NAVFACCONTRACEN 1996)

Table 2.3 NAVFAC A/E Acquisition Process. (NAVFACCONTRACEN 1996)

Process	Action	Time
Requirement identification	User	Varies
Acquisition planning	EFD PM	2 Days
Advertisement	Contracts	2 Months
Qualification statements received	Evaluation Board	1 Month
Slate/preselection board meeting	Evaluation Board	2 Weeks
Slate/preselsction board report	Chairman of the Board	1 Week
Request for Proposal	Contracts	1 Week
Government estimate preparation	EFD PM	2 Weeks
Receipt/review of proposal	A/E Firm	2 Weeks
DCAA Audit (over \$500K)	Contracts	30 Days
Prenegotiation objectives established	Contracts/Tech Rep	2 Weeks
Negotiation	Contracts/Tech Rep	2 Days
Post Negotiation Memorandum	Contracts	1 Week
Contract Award	Contracts	1 Week
Contract Administration	Contracts/ROICC	Varies

#### 2.4 Length of Acquisition Process

In 1989, NAVFAC conducted a study to determine how long it took to obtain A/E services. The results showed that from the time a project was authorized until the contract was signed, 330 days had elapsed. This was unacceptable to NAVFAC. Private industry would go out of business waiting nearly a year to select their design firms. As a result of the study conducted in 1989, NAVFAC made some recommendations which led to (NAVFACENGCOM 1989):

- Less time required to award an A/E contract.
- More responsive to customer needs.
- Better customer satisfaction.
- Increased quality of A/E selection and supporting document
- Reduced paperwork.
- Enhanced teamwork and ownership of the outcome.
- More efficient manpower utilization

As part of this study, a brief survey was conducted by telephone interviewing Engineering Field Divisions and Engineering Field Activities, (EFD/EFA) within NAVFAC. The interviews conducted include the following four Commands: EFA Northwest, EFA Chesapeake, EFD Southwest and EFD Pacific. The result of survey indicates that, the average procurement time has been reduced to four months, a seven month improvement in the acquisition process. This supports information provided in the curriculum taught at the Naval Facilities Engineering Command Contracts Training Center which states that the normal procedure for contracting an A/E firm should take 117 days for a standard project. Table 2.4 shows the time frames associated with different project priorities.

The time frames for the four other methods vary from 32 to 74 days to award a contract. Track B, Fast Track, essentially, goes through the same process as the standard, but involves more senior management interest and the contract is hand carried through the process. Track C, Generic Slate, are routine projects that are less than \$10 million. Basically, a slate of three firms are chosen from a pre-advanced list by region. The updating of the list is done twice a year. A standing slate board then chooses from 3 interested firms. Essentially, the lengthy process



of formal slate/select boards is eliminated. Track D, Urgent and Compelling, is used if the project is considered mission essential, an operational necessity, or the customer certifies urgency. In any case, a Justification and Authorization (J & A) must be signed for this approach. Finally, Track E, the Indefinite Quantity, (IDQ) contracts are used as needed by type of contract. Normally a minimum and maximum amount are stated on the contract. One large contract is awarded to an A/E firm and as design services are needed within scope of the originally contract, a delivery order is written that specifies the requirements and specific scope of work to be accomplished. (NAVFACCONTRACEN 1996)

Table 2.4 Priority System. (NAVFACCONTRACEN 1996)

Track	Priority	Time
A	Standard Process	117
B	Fast Track	74
C	Ready/Generic Slate	37
D	Urgent and Compelling	32
E	Indefinite Quantity	51

While the study conducted in 1989 led to the initiative as mentioned previously, NAVFAC also gave the EFD/EFA/PWC's flexibility to adapt work processes to meet the user's needs while maintaining their own organizational goals.

Even more important today with the closing of bases and restructuring, the Navy continues to look at ways to reduce manpower while improving capability. Technology will play the primary role in being able to accomplish this task. That is why it is important to periodically address questions such as does it make sense to spend valuable resources and money trying to choose the most qualified A/E firm for every project? FASA has resolved the time length issues for small contracts.

Why not review current projects and base decisions on the successes and failures of projects rather than a set policy based on anecdotal information? The A/E selection procedure really has not been reviewed since the early 1970's. The same philosophy holds true for Design/Build projects. Now that the Navy has been using design build for over five years, it is time to conduct statistical study to analyze project data to determine how much benefit or impact the Design/Build process has versus the Design/Bid/Build.

## **2.5 Phase I Background**

The following discussion from the Phase I Background through the next two Chapters is taken from the Phase I report A/E Service Selection Method which was generated by the Department of Civil Engineering at the University of Texas at Austin (Vanden Bosch et al. 1996).

Key participants within the construction industry report a growing new trend in design firm selection from selection based solely on the qualifications of the design firm towards selection based solely on price. However, selection based solely on price alarms many design firms and professional organizations, who feel that such a focus will substantially degrade the quality of the design service. This will in turn result in completed projects that do not fully meet client needs and expectations.

Reoccurring attempts have been made both to weaken and to strengthen the Brook's Act. To date, the act has survived intact, but is under increasing attack. The Justice Department has required professional societies to remove

ethics clauses in their by-laws that prevented the competitive bidding of services on the grounds that such clauses violated anti-trust laws. Thus inherent tensions between pricing pressure and qualifications pressure for design services are likely to continue. The Brook's Act is not without its critics, who charge that the act is inherently biased, discriminatory, and restricts competition. These criticisms are further explored in Chapter 3.

The current arguments both for and against QBS are based on anecdotal data. The problem with anecdotal examples is that there is no test to determine if they are extreme examples of infrequently occurring events, or to what degree the examples represent the central tendencies of the general population. Because of this, anecdotal examples cannot be used to establish population trends or even to prove a point. Therefore, a statistical study needs to be performed to evaluate the efficacy of QBS.

## **2.6 Objectives of Phase I**

Phase I set up the framework for this study. The primary objectives of Phase I were to:

- 1) Develop data gathering procedures and tools for further study,
- 2) Address sample size and availability of data for further study,
- 3) Conduct reviews of the proposed methodology in order to refine gathering procedures and tools,
- 4) Make necessary refinements in the procedures and tools, and
- 5) Communicate all findings in a report.

## **2.7 Scope of Phase I**

The scope of Phase I was to develop statistically sound survey tools for gathering relevant project information linking a project's performance and the

method of selection of its design service provider. The scope of research is therefore to:

*1. Build on prior studies*

In any study involving substantial issues and possibly affecting policy and/or legislation, it is incumbent on the research team to extensively search existing literature for similar or related studies, and, if such studies exist, build on their results. Phase I of this study includes such an effort. The results of the literature review are presented in Chapter 3.

*2. Develop/Modify tools*

Every statistical study is unique. The researchers, therefore, must develop a survey instrument and approach that meets the needs of this study. The survey instrument from phase I has been refined and is given in appendix A.

*3. Address statistical issues*

There are many issues associated with statistical analysis that can affect the usability of data.. Failure to account for these issues could damage the analysis effort. These issues are briefly discussed at the end of Chapter 3 and further elaborated in Chapter 4.

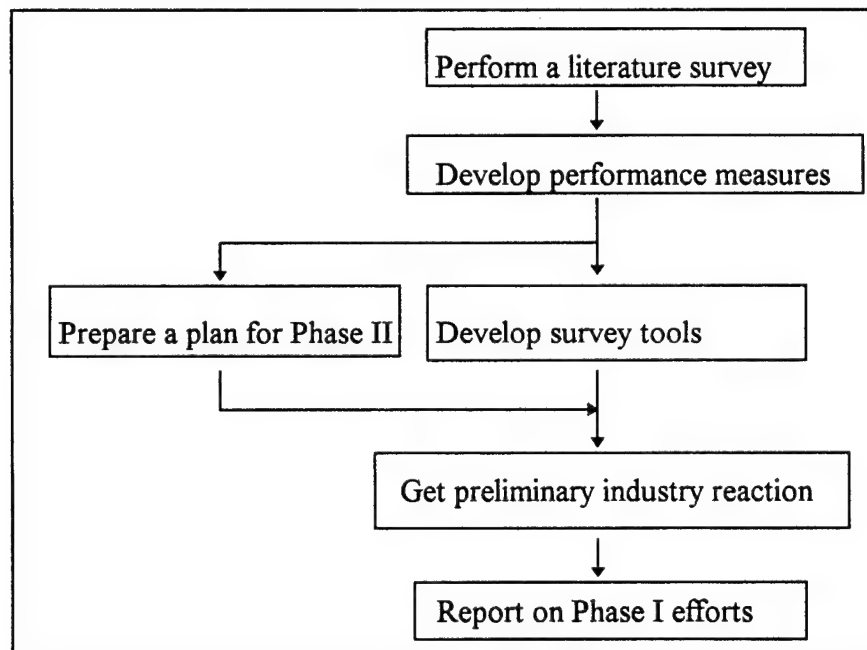
*4. Get preliminary industry reaction to methodology and tools*

The proposed exploratory survey methodology and data gathering approach were evaluated by independent individuals knowledgeable in the A/E/C industry. Improvements were made based on their suggestions. Preliminary feedback on the draft methodology and survey tools is presented in Chapter 3.

## 2.8 Methodology of Phase I

The methodology employed in Phase I is depicted in Figure 2.2 and has been completed. This study is the pilot test of the survey tools developed in Phase I.

Figure 2.2 Methodology of Phase I



## **Chapter 3: Preliminary Investigation**

### **3.1 Literature Summary**

An extensive literature search was performed during Phase I, and an annotated bibliography of the relevant literature is presented in the Phase I report. Findings of the literature review are summarized below. (Vanden Bosch et al. 1996)

#### *The Brook's Act*

As previously discussed, the Brook's Act controls how federal agencies select design firms for federal projects. The act requires federal agencies to invite at least three architect or engineering firms to be considered for each selection process. These firms are then ranked in order of their qualifications alone. The highest ranked firm is selected. Pricing considerations are addressed in the Act by requiring the agency to negotiate only with the highest ranked firm, and if negotiations are successful, award to that firm. If the negotiations are unsuccessful, the agency terminates that selection and moves on to the next highest qualified firm. (FAR 36.6)

Critics of the Brook's Act complain that the act is inherently biased toward large, established firms, and discriminates against new, small, and minority firms. (Hampton 1994) Such criticisms have appeared in court cases contesting the selection of one design firm over another. Without disputing such allegations, the federal courts have nevertheless upheld the Brook's Act, and it has withstood all such challenges. (485 Federal Supplement 1292; B-201395.2 1982; B-218404.2;

B-218474) Another concern is that even though the Federal Acquisition Regulations (FAR) declares that the selection process promulgated by the Brook's Act must meet the requirements of "fair and open competition" by law, in fact it is restricted competition with sole-source negotiations, two terms which experienced public procurement officials usually associate with exorbitantly higher prices. (FAR 36.6)

To counter against the assaults on the Brook's Act, the major professional societies have formed an organization to review and study the issue of how best to defend the Brook's act. That organization is the Committee on Federal Procurement of Architecture and Engineering Services (COFPAES). COFPAES' interest, though primarily federal, extends to the state and local levels. In addition to COFPAES, a recent report from Massachusetts presents anecdotal information supporting the Brook's Act's use. (AIA 1996; Massachusetts Taxpayer's Foundation 1995)

There are many processes in use for selecting the design service provider. Perhaps the most common classification is a modification of the classification system used by the Professional Services Management Journal (PSMJ) in their annual design fee survey. (PSMJ 1996) The modification of the PSMJ classification rather neatly proceeds from pure price-based selection, to pure qualifications based selection and was given earlier in Table 1.1.

#### *Price-Based Selection Trends*

The trend towards price-dominated selection of A/E services appears to be leveling off. There is some indication that the practice is abating as owners and

others learn that the anticipated costs savings do not occur in the long run. (Architectural Record 1994; Hathway 1995; Ichniowski et al. 1995; PSMJ 1996)

Price-only selection comes from private owners, other service providers, construction contractors, and public agencies at the federal, state and local levels. Pricing considerations in the selection of a design service provider are significant in the public sector, as well as the private sector. By law, some states require the design service provider to bid for public projects. Many other government and quasi-government agencies, districts, boards, and other public service providers appear to practice selection of the project designer based only on price, regardless of laws apparently to the contrary. Surprisingly, A/E firms subcontracting work to smaller consulting firms often do so based primarily on price. (Angelo 1995; Schriener 1995; Massachusetts Taxpayer's Foundation 1995; PSMJ 1996)

Public sector price pressures driving selection of design service may be attributed in part to the Federal Acquisition Regulations (FAR) *Part 6 - Competition Requirements*, and in particular to *Subpart 6.1 - Full and Open Competition*, where paragraph *6.101 Policy* establishes full and open competition as the normal policy of the land. All other procedures are limited exceptions usually requiring a written justification and higher authority approval, unless a statutory exception (such as the Brook's Act) provides otherwise. Moreover, *Subpart 6.5 -- Competition Advocate*, requires each agency to appoint a competition advocate to actively promote full and open competition. Finally, the Brook's Act itself appears to be mandatory only when the contracted services require a licensed professional A/E to perform them. Those A/E services not



requiring a professional license and signature may not be mandatory. (Lunch 1994; USCA 40; B-201395.2 1982; FAR Part 6)

The public policies embodied in the FAR regarding competition are rooted in a pronounced desire by taxpayers to minimize their tax burden. Taxes are the pre-dominate source of government revenues for public projects. One of the consequences of this is reflected in public policies at all levels of government to obtain goods and services for public use at the lowest reasonable price. The predominate method adopted by nearly all public procurement offices to minimize the cost of such goods and services is to define the requirements, and publicly invite all interested parties to submit their price (bids) for providing the goods or services. (Lunch 1991; Korman et al 1995; ENR 1991; DeFraités 1989)

Private sector price pressures driving selection of design services may be attributed to the perception that design services are a commodity, caused in part by design firms limiting their liability to the owner. The extensive use of standard form design contracts also adds to this view. The perception that there is little difference between A/E firms is pervasive. (Architectural Record 1994; Korman et al. 1995; Grogan 1995; PSMJ 1996)

### *Project Performance*

In a series of meetings held in Fall 1995, the research team developed a list of project *outcome* and project *process* performance criteria based on team expertise, and significant prior research work performed by the Construction Industry Institute. (CII et al. 1986-1994) The project performance categories include:

- Total installed cost (TIC) cost performance
- TIC cost performance relative to industry benchmark
- Unit construction cost
- Cost of design quality relative to TIC
- Cost of construction quality relative to TIC
- \$ amount of claims or litigation relative to TIC
- Overall schedule performance relative to owner goals
- Overall schedule performance relative to industry benchmark
- Jobsite safety performance relative to goal
- Jobsite safety performance relative to industry benchmark
- Level of customer (owner) satisfaction
- Plant/facility output performance relative to owner requirements
- Safety of facility operations and maintenance
- Aesthetics of facility
- Cost efficiency of facility operations
- Cost efficiency of facility maintenance
- Job profit of A/E
- Job profit of contractor
- Satisfied project personnel
- Accessibility to new service providers
- Ease of overall project delivery from owner's perspective
- Amount of required owner front-end costs
- Fair system of selection with integrity and minimal corruption, abuse, or protests
- Ease and uniformity in execution of selection process

These project outcome and project process performance categories were used to develop the survey instruments as described in Chapter 4. Issues of diversity, complexity, and difficulty in measurement were addressed by the research team as well.

There are many influences to project success. One of the most important influences is in the design stage of the project, where small changes in the design process may have enormous cost consequences in construction or operations.

### *Statistical Studies*

The literature review revealed no rigorous statistical studies concerning qualifications-based selection of A/E services. The study will therefore be exploratory in nature and should include multiple sources of data and data gathering methods as discussed in Chapter 4.

### **3.2 Overview of Statistical Procedures**

Several methods exist for statistical analysis of data. All generally acceptable methods today are founded in probability theory and a rigorous and a carefully executed data collection process. (Knoke et al. 1982; Babbie 1990) To roughly frame the available analysis techniques, two broad techniques are used below: means and variance testing, and analysis of variance. The Phase I report addressed these techniques in detail (Vanden Bosch et al. 1996)

Of the many thousands of projects that could be examined, there is time and money for only a limited sampling of the projects that exist. Generally, completed projects are necessary to measure overall project performance, so all uncompleted projects will be excluded. Much of the data required for this study is not likely to be kept in a single file, or even in a single location. In addition, much of the data is probably resident only in the minds of the key project participants. Therefore, the availability of data, and the availability of knowledgeable persons, is a requirement. Projects completed more than five years ago will be excluded on the basis that the time lag for personal recall is too great to be reliable.

Projects too small or too large in size may disproportionately distort the analysis results. Therefore projects less than \$2 million and more than \$60 million are expected to be excluded from the study.

The diversity of projects in the universe of all construction projects is too great to include all types of projects. It was proposed to limit the project sectors to buildings, horizontal construction, and light industrial.

The building sector consists of general buildings and low-rise structures such as jails, prisons, correctional facilities, schools, maintenance facilities, office buildings, retail stores, but not high-rise buildings.

The horizontal construction sector consists of roads and highways, earth dams and levees, flood control structures, irrigation, power transmission systems, water distribution systems, sewage collection systems, and grading, excavation or landscaping.

The light industrial sector consists of power plants, water treatment plants, and sewage treatment plants.

### **3.3 Preliminary Interview Feedback**

The developed survey tools and proposed methodology were reviewed with knowledgeable industry officials to provide a reality check on their direction, applicability, and completeness. In addition, the interviews uncovered areas that require further attention. These recommendations were incorporated into the survey design and methodology. (Vanden Bosch 1996)

### **3.4 Pretest**

This thesis addresses the need to further test the survey questionnaires on a small, select sample in order to get detailed feedback. The next chapters give detail of this effort along with initial results of this small sample. In addition, a brief critique of the Phase I survey instruments is given as well.

## Chapter 4: Methodology

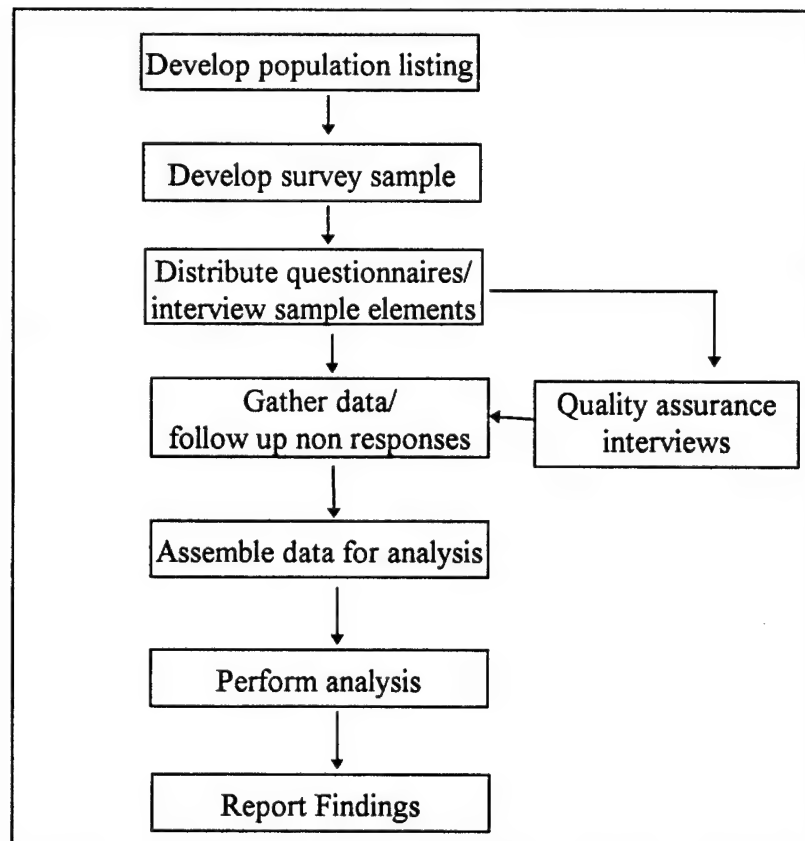
### 4.1 Hypothesis

In statistical analysis, a hypothesis is a statement of the intent of the statistical analysis, i.e., what it is the study is attempting to establish. For this study the hypothesis is, in its simplest form, that *project performance is related to the method of selection of the designer*. More specifically, project performance is negatively related to pricing pressures exerted on the design service provider during his/her selection process. A hypothesis cannot be directly proven, so its opposite, or null position is disproved. (Knoke et al. 1982; Babbie 1990) The null hypothesis for this study is that there is no significant relation between project performance and the method of selection of the design service provider.

## 4.2 Methodology

This section presents the steps and data collection techniques that were executed and discusses statistical analysis issues affecting the usability of the study results. Figure 4.1 shows the methodology for the proposed study. The work accomplished in this thesis has addressed the methodology on a small scale in order to pilot test the survey approach.

Figure 4.1 Methodology



### **4.3 Data Gathering Procedures**

The sampling frame was developed from available sources. Once the sample projects were identified, key individuals for each project in the sample were contacted. Personal contact, either by telephone or face-to-face, was made with each key project individual.

Once the questionnaires were delivered, follow-up interviews were made as required to address questions, or to maintain and induce enthusiasm in the respondents to complete the questionnaires, thus insuring a reasonable sample response rate. Data quality was monitored as the data were received, and follow-up contacts made to resolve unclear and missing data.

### **4.4 Data Analysis Procedures**

Meaningful data analysis is largely dependent on receiving all or most of the sample data. While the major focus of this study was project performance and the A/E selection method, there were other factors that affected project performance. Not every factor below affected this pilot study, but are included on the list to show the factors that were taken into account:

- (1) Externally driven factors, such as
  - competitive market conditions
  - local regulatory and permit requirements
  - labor strikes
  - material availability
  - abnormal weather
  - civil unrest, war, and insurrection
  - acts of God



- (2) Owner controlled events, such as
  - pre-project planning
  - contracting strategy
  - design reviews
  - constructability program
  - construction manager
  - time constraints
  - use of incentives
  - financing or funding constraints
  - partnering
  
- (3) Project specific factors, such as
  - Remoteness of the site
  - complexity of the project
  - uniqueness of the project, e.g.:
    - prototype
    - first of a series
    - new process or technique
  
- (4) Constructor controlled events, such as
  - experience
  - proclivity to claim
  - attitude
  - safety practices

Project success is a combination of cost, schedule, quality and owner satisfaction. All of the above factors can independently affect any and all of these project success measures. Therefore it is necessary to include, or account for, the influence of these factors in the data. (Knoke et al. 1982; Babbie 1990) Once all these other influencing factors were controlled for in data collection, the resulting data was analyzed regarding project performance and A/E selection method.

At this point in the analysis, the sub-sample groupings were tested to see if they were significant, i.e., if they were statistically different from each other. If the sub-sample groupings were significant, then two questions remain:

- 1) "Do the project success factors co-vary with the A/E selection methods?", and if so,
- 2) "How strong is the co-variance relationship?"

#### 4.5 Data Gathering Tools

Based on the project performance categories presented in Chapter 3, a matrix of questions and requirements was developed as shown in Table 4.1 corresponding to the questionnaire presented in Appendix A.

TABLE 4.1 Performance Criteria/Questionnaire Matrix

PERFORMANCE CRITERIA (1)	SURVEY QUESTION(S) (2)
<i>OUTPUTS:</i>	
1. TIC Cost Performance	2.2.1
2. TIC cost performance relative to industry benchmark	2.2.1 and 2.1.6 (make our own sample comparison)
3. Unit construction cost	2.1.6
4. Cost of design quality relative to TIC	2.2.1 and changes question(possibly)
5. Cost of construction quality relative to TIC	2.2.1 and changes question (possibly) (4. and 5. are difficult and probably understated)
6. \$ amount of claims or litigation relative to TIC	2.6.1 and 2.2.1
7. Overall schedule performance relative to owner goals	2.3.1-6
8. Overall schedule performance relative to industry benchmark	2.1.6 and 2.3.1-6 (make our own sample comparison)
9. Jobsite safety performance relative to goal	2.7.4.a
10. Jobsite safety performance relative to industry benchmark	N.A.
11. Level of customer (owner) satisfaction	2.7.1.a; 2.7.8
12. Plant/facility output performance relative to owner requirements	2.5.1; 2.5.2
13. Safety of facility O & M	2.7.6.a-c
14. Aesthetics of facility	2.7.3.c
15. Cost efficiency of facility operations	2.7.5a-c
16. Cost efficiency of facility maintenance	2.7.6.a-c
17. Job profit of A/E	N.A.
18. Job profit of contractor	N.A.
19. Satisfied project personnel	N.A.
20. Accessibility to new service providers	N.A.
21. Ease of overall project delivery from owner's perspective	N.A.
22. Amount of required owner front-end costs	N.A.
23. Fair system of selection with integrity and minimal corruption, abuse, or protests	2.6.1; 2.6.2
24. Ease & uniformity in execution of selection process	N.A.

Using this matrix, the project performance questionnaires were developed. Three variations of the project performance questionnaire were developed, however, only the one for the building sector was used in this pilot study.

Column 2 of Table 4.1 shows the question number in the project performance questionnaire. Issues in Table 4.1 without corresponding questions are shown by "N.A." in column 2 of the table. Such issues are not addressed because the research team felt they were too hard to obtain data, or were too sensitive.

In addition to the performance measurement questions generated from Table 4.1, questions to control for the other factors that affect project success, discussed in the antecedent *Data Analysis Procedures* section, are included in the project performance questionnaire under question 2.1.7. These questions are designed to allow the isolation of the effects of the A/E selection method on project success factors in the data analysis.

Finally, questions are included in the questionnaires to probe respondents in terms of project type, designer, background information on the project, identification of key personnel, participating firms in the project, etc. These types of questions are at the beginning of the questionnaires. See appendix A for the final copy of the project performance questionnaire.

#### **4.6 Service provider questionnaire**

The A/E point of contact (POC) was included in the project performance questionnaire. Once this information was received, a separate service provider questionnaire was sent to the A/E.

The service provider questionnaire was developed in brainstorming sessions by the research team incorporating the results of the literature review. A separate questionnaire was developed because it became clear that the design service provider was best positioned to answer those questions, while the owner was best positioned to answer the project performance questionnaire. Projects were segregated into QBS, non-QBS, or a combination of the two based on responses to this questionnaire. See appendix B for the final copy of the service provider's questionnaire.

## **Chapter 5: Presentation and Data Analysis**

### **5.1 Characterization of Sample**

The pilot sample comes from a combination of two sources. The first source was generated by F. W. Dodge who provided 461 randomly selected building sector projects. These projects have been completed within the last year and are representative of America's construction industry. The other source of projects came from locally selected projects in the Austin, Texas area based on personal contacts. From the 461 projects, nine projects were randomly selected within the state of Texas and three projects were chosen locally. The scope of the sample size was limited to Texas because of funding and timing constraints.

This study will set the foundation for the next research phase which will be conducted on a much broader scale. The more comprehensive analysis will include projects encompassing the United States and will also include the horizontal and utilities sectors of construction. As discussed earlier, this study is a pilot study to determine the response rate and quality of questionnaire. Based on the feedback provided by the initial sample, the questionnaire will be modified.

The specific types of projects chosen are schools, apartment, and office /retail buildings. The size of projects range from 70,000 to 320,000 gross square feet (GSF) and total installed cost of 4 to 25 million. The response rate of all the questionnaires sent out was 66 percent. As previously mentioned in the methodology, the owners were initially contacted by phone and ask if they were willing to participate. Once the questionnaires were received from the owners, the A/E firms were contacted and asked to fill out the service acquisition

questionnaire. There were a 100 percent response rate once the A/E firms knew that they were referred to by the owners. Table 5.1 characterizes the sample used in this study.

Table 5.1 Sample Characterization

Project	SF	Total \$	Location	Type Project	Source
(1)	(2)	(3)	(4)	(5)	(6)
P001	120,000	\$10,676,000	Austin, TX	Apartments	Local
P002	319,000	\$21,770,000	Irving, TX	Manufactung	FW Dodge
P003	197,000	\$19,000,000	Travis CA	Retail	FW Dodge
P004	62,957	\$4,104,725	Laredo, TX	Hotel/Motel	FW Dodge
P005	71,000	\$4,325,930	Harris C TX	Retail	FW Dodge
P006	65,000	\$11,600,000	Plano, TX	School	FW Dodge
P007	67,000	\$4,500,000	Austin, TX	Apartments	Local
P008	78,000	\$6,070,658	Austin, TX	School	FW Dodge
AVG	122,495	\$10,255,914			

## 5.2 Characterization of QBS and Non QBS

The Brooks Act is very clear on the selection process for A/E firms. The selection of the firm has to be made based on qualifications alone, then negotiations occur with a goal of obtaining a fair and reasonable price not to exceed six percent to the most qualified firm. If the negotiations are unsuccessful, the negotiation process goes to the next most qualified firm and so on. The exact opposite of QBS would be selection based on price alone such as a sealed bid. A third category is a combination of the QBS and non-QBS. This can happen a number of ways, but typically, the owner will make his selection after reviewing pricing data. In essence, the owner is looking for the "Best Value". Table 5.2 below again summarizes the different categories that were addressed earlier.

Table 5.2 A/E Selection Methods (Vanden Bosch et al. 1996)

DESCRIPTION	
<b><u>Non-QBS</u></b>	<i>(Price)</i>
<b>Bid</b>	Price is the only selection determinate.
<b><u>Combination</u></b>	<i>(Pre-qualification, Price)</i>
<b>Two envelope</b>	The first envelope contains qualifications only. All highly qualified firms are pre-qualified. Pre-qualified firms are invited to submit price proposals. The second envelope contains the price proposal. Award is based on best price.
<b>One envelope</b>	<i>(Best value, considering qualifications and price)</i> Firms simultaneously submit qualifications and price. Award may be based on some combination of price and qualifications.
<b><u>QBS</u></b>	
<b>Two envelope</b>	The first envelope contains qualifications only. The one best qualified firm is selected and asked to submit a price proposal. Price is negotiated with the one best qualified firm only.
<b>Sole source</b>	<i>(Reputation is the selection determinant)</i> The firm is selected based on their reputation and/or familiarity with client's project. Price may or may not be negotiated.

From this pilot study, only two categories were observed. The two are "QBS" and "Combination" based on responses from the service provider questionnaires. Table 5.3 separates these two types.



### 5.3 QBS/non-QBS Characterization

Project (1)	QBS, Q/Combination, C (2)
P001	Combination
P002	Combination
P005	Combination
P006	Combination
P003	QBS
P004	QBS
P007	QBS
P008	QBS

None of the projects from the sample were based solely on price. In each case some degree of qualifications was a factor. The key to separating between "QBS" and "Combination" was question number three in the Service Acquisition Questionnaire. The bottom line in separating the two was if the A/E firm was selected before negotiations took place, then the project was categorized as QBS.

Selection of these sample projects was not done on a purely random basis. The projects from the Texas area were targeted because of the time constraint of this effort. However, there were no measures taken to ensure a 50 percent subsamples existed between QBS and non-QBS projects. Of the projects selected from Texas half were identified as QBS and the other half as a combination or "Best Value" which is explained in Table 5.2. From these results, the conclusion

is that price pressures are probably being exerted by owners on A/E firms on a large number of projects in today's construction industry.

### **5.3 Analysis of Data**

There are numerous ways to measure project success. For the purpose of this study. The factors will be broken into cost, schedule, changes, positive and negative factors, subjective design ranking and overall project success ratings by the owners. In terms of cost, the area of concentration will be percentage of design cost and various cost per square foot comparisons. Evaluation of schedule will include actual time and also the subjective opinions of the owners. Changes will be presented as a percentage of actual construction cost. Finally, the positive and negative factors will be grouped in one table to summarize the owner's overall ranking of the success of the project. All data presented will segregate the QBS and non-QBS projects.

### **5.4 Design Cost**

The first analysis is to look at the cost of design. Remember, the Brooks Act allows no more than 6 percent of estimated construction cost for Federal projects. This provides a check on whether design fees exceed the six percent statutory limit and also gives a relative comparison between QBS and non-QBS. Columns (3) and (4) in Table 5.4 represent the cost of design and construction at the completion of the project. Column (5) is the percentage of design with respect to column (4).

Table 5.4 Design Cost of Sample Projects

Project	Q/N	Design, D \$	Construction, C \$	% D
(1)	(2)	(3)	(4)	(5)
P001	C	\$300,000	\$10,676,000	2.81
P002	C	\$1,400,000	\$21,770,000	6.43
P005	C	\$126,000	\$4,325,930	2.91
P006	C	\$610,000	\$11,600,000	5.26
C Avg.		\$609,000	\$12,092,983	4.35
P003	Q	\$1,386,000	\$19,000,000	7.29
P004	Q	\$167,748	\$4,104,725	4.09
P007	Q		\$4,500,000	
P008	Q	\$299,773	\$6,070,658	4.94
Q Avg.		\$617,840	\$8,418,846	5.44

Focusing on column (5) in Table 5.4, two percent of the projects exceeded the 6 percent threshold set by the Brooks Act, one from each sample. The problem with evaluating design cost is the various definitions that exist in the construction industry. Design fees can include a multitude of services from site visits to drawings to assistance with contract administration. The Brooks Act allows no more than 6 percent of estimated cost of construction, however, this only includes basic services such as providing the specifications and drawings for the project. Other services such as site visits and modification support can be added on top of the 6 percent. Therefore, it is very important to ensure the design services for each project are specifically defined.

As probably expected, the owners of the projects that applied price pressures on the A/E firms on the average paid 20 percent less for design services. The results are shown in column (4) of Table 5.5.

## 5.5 Cost/SF Analysis

Cost per square foot is another essential success factor to analyze. Designers, developers and owners are continually thinking about the bottom line, cost per square foot. Most likely, the cost of the building or leasing space is estimated and leased on cost per square foot basis. Table 5.3 below shows several Cost/SF comparisons. Columns (2) and (3) are basically the design and constructions costs divided by the total square feet of the facility.

Table 5.5 Cost/SF for the Sample

Project	Design SF	Const. SF	Q/N
(1)	(2)	(3)	(4)
P001	\$2.50	\$88.97	C
P002	\$4.39	\$68.24	C
P005	\$1.77	\$60.93	C
P006	\$4.69	\$89.23	C
Avg.	\$3.34	\$76.84	
P003	\$7.04	\$96.45	Q
P004	\$2.66	\$65.20	Q
P007	NA	\$67.16	Q
P008	\$3.84	\$77.83	Q
Avg.*	\$3.39	\$76.66	

\*Average for P003, P004 and P008

Analyzing columns (2) and (3) from Table 5.5, the owners that are applying price pressures are saving 1.5 percent on the design cost and spending .23 percent more on the construction cost. Using the average size facility and construction cost from columns (2) and (3) of Table 5.2, average savings of the owners on design costs is \$6,125 and the increase spending for construction is

\$22,049. The owners that went through a qualifications process saved more money than the non-QBS projects. The margin is essentially the same for a sample size of eight projects. On multi-million dollar projects, a difference of a few thousand dollars is not statistically significant.

### 5.6 Schedule Analysis

Completing a project on time is extremely important. In general, the less time the contractor stays on the project the more profitable he will be. This will also give the owner earlier access to the facility. Regardless which side of the project a firm is on, schedule is an important success factor to measure. In table 5.6, columns (3) and (4) show planned and actual duration of the project in months. Column (5) is the percentage difference between columns (3) and (4).

Table 5.6 Schedule Analysis

Project	Q/C	Planned	Actual	% Diff.
(1)	(2)	(3)	(4)	(5)
P001	C	8	8	0
P002	C	12	13	+ 8
P005	C	18	18	0
P006	C	6	6	0
			C Avg:	+ 2
P003	Q	12	24	+ 100
P004	Q	8	7	-14
P007	Q	16	20	+ 25
P008	Q	24	24	0
			Q Avg:	+ 28

The non-QBS type projects rated much better in terms of completing on time. Project P003 seems to sway the results. The delays in that project were

mainly caused by a weather delay of 20 weeks and engineering and construction productivity delays of 18 weeks. Even if that data point is thrown out, the non-QBS projects would have still completed their projects 10 percent faster. This is opportunity cost lost by the owner and the contractor. Again, a larger sample size and a more specific breakdown of delays caused solely by design errors should be analyzed.

### 5.7 Changes Analysis

The majority of the contractors and owners prefer no changes because they disrupt the schedule and have a cascading effect on other aspects of the project. Changes occur on almost every project and the key is to minimize the changes that are controllable. In table 5.7, column (3) is the number of changes that occurred on the project. Column (4) represents the cost of the changes and column (5) is the percentage of changes with respect to the actual cost of construction.

Table 5.7 Changes Analysis for the Sample

Project	Q/C	# of Changes	Changes (\$)	% of Changes
(1)	(2)	(3)	(4)	(5)
P001	C	25	\$ 1,400,000	13.1%
P002	C	134	\$ 2,000,000	9.2%
P005	C	26	\$ 1,751,036	40.5%
P006	C	0	0	0
			Avg:	15.7%
P003	Q	108	\$ 7,000,000	36.8%
P004	Q	4	\$ 111,993	2.7%
P007	Q	NA	\$ 20,000	0.4%
P008	Q	9	\$ 35,000	0.6%
			Avg:	10.1%

The standard contingency on a new construction project is typically five percent. These data show that the QBS process appears significantly better than the non-QBS for this small sample. The QBS projects on the average paid 5.6% less for changes. This seems logical. The better qualified the A/E firm, the less design errors should be expected during a project. Naturally, all the changes were not attributed to design errors, therefore in the future, the questionnaire should focus mainly on design changes.

### **5.8 Owner's Subjective Analysis**

The final analysis is the subjective project perception from the owner's perspective. Since these are only from the owners perspective, there will be some bias. In future studies, perhaps a ranking of the owner and project can be done by the design firm as well. In table 5.8, column (3) are the negative and positive factors that influenced the project, such as external, owner controlled or project specific as discussed earlier in section 4.4. See appendix A, question 2.1.7 for a complete breakdown of these factors. Column (4) provides the design ranking on a scale of 1-5 with 1 being very unsuccessful and 5 being very successful. Column (5) is the overall ranking of the project from 0 to 100.

Table 5.8 Owner Subjective Analysis

Project (1)	Q/C (2)	Factors (-, +) (3)	Design Ranking (4)	Overall Ranking (5)
P001	C	(14, 0)	3	82
P002	C	(0, 13)	3	80
P005	C	(1, 13)	5	92
P006	C	(2, 0)	1	90
	Avg	(4.25, 6.5)	3	86
P003	Q	(11, 0)	3	65
P004	Q	(6, 3)	4	72
P007	Q	(4, 6)	4	92
P008	Q	(3, 8)	4	65
	Avg	(6, 4.25)	3.75	74

The QBS A/E *firms* ranked higher than the non-QBS in terms of design effectiveness, however, the *projects* from the non-QBS ranked higher than the QBS. The non-QBS projects did have more positive and less negative factors than the QBS.

### 5.9 Evaluation of Data Collection Method

The questionnaire method of collecting data takes a long time, especially since most professionals are using voice mail and personal contact is difficult. Initial contact can take three to four calls. Once the point of contact is located, a high degree of promoting the research project is a key to quick response. The response rate for this project was approximately: 25 percent said no; 25 percent returned within the specified time stated in the initial request, and 50 percent took multiple reminders. Therefore, it is very important in the initial contact to be



prepared. In short, the researcher should sound enthusiastic, search for common links, be concise, and get a firm commitment.

The questionnaire on the average took approximately 45 minutes to complete by the respondent. Some of the problems that occurred during the collection of data can be improved by modifying the questionnaires. The author recommends changing the following questions:

*Project Performance Questionnaire*

**a. Current:**

2.1.5 What is the approximate size or design capacity of this facility?  
(EXAMPLES:: gross square feet, number of beds, etc. )

New:

2.1.5 What is the approximate size of the facility? \_\_\_\_\_SF

**Reason:**

Design capacity focuses on the industrial type project.

**b. Current:**

2.2.1 What was the capital cost breakdown, by the following major cost categories, for the estimated cost at the time of major funding authorization and the actual final cost of the project? In order to assist you in completing this section, guidelines for selected cost categories follows:

Owner Costs: The direct owner incurred costs, excluding procured equipment or any subcontracts.

Owner Procured Equipment/Materials: The costs associated with owner procurement of any equipment or materials inclusive of any capitalized subcontract costs (i.e., procurement by a subcontractor on an owner's purchase order).

Total Project Cost	Estimated Cost *	Actual Cost
Owner Costs		
Owner Procured Equipment/Material		
Engineering & Design Services		
Construction Contractor Equip, Material & Labor		
Commissioning, Turnover, & Startup		
Contingency		XXXXXXXXXX X
Other		
<b>Total Project Cost</b>		

\* at Authorization/Appropriation

**New:**

2.1.1 What is the cost breakdown of the project:

	Estimated	Actual
a. Construction	_____	_____
b. Land/Capital	_____	_____
c. Design	_____	_____

Describe the design services that are being provided:

\_\_\_\_\_

\_\_\_\_\_

d. Other

e. Total Cost: \_\_\_\_\_

**Reason:**

Some of the factors in the original question are more for industrial type projects. Also, the description of the design is necessary to ensure the research is comparing the same amount of services. For example, if one design firm is only providing drawings while the other is providing additional site visits, etc., then it is not fair to compare the two.

**c. Current:**

2.4.1. What was the total approximate number of change orders issued (*including engineering and construction*)?

\_\_\_\_\_

2.4.2. What was the total dollar amount of all change orders?

\$ \_\_\_\_\_

(*approximate, if necessary*).

2.4.3 What was the net change in the completion date resulting from change orders? \_\_\_\_\_ months

Did the net impact of the changes increase or decrease the length of the original project duration? (*Please check only one answer*)

☐ Increase    ☐ Decrease    ☐ No change in project duration

**New:**

2.4.1 What was the total approximate number and cost of change orders issued:

	Number	Cost
Due to Design Errors	_____	_____
Due to Unforeseen conditions	_____	_____
Due to Owner	_____	_____
Other _____	_____	_____
Total	_____	_____

2.4.2 Omit

2.4.3 What was the net change in the completion date resulting from change orders? \_\_\_\_\_ months.    ☐ increase    ☐ decrease

**Reason:**

Data is in a more useful format. Also, it can specifically isolate the design category which is the focus of the study.

**d. Current:**

2.5.1 What percent of design capacity (usable space, or capacity) was planned or anticipated at the time this project was authorized and actually obtained 6 months after substantial completion?

2.5.2 What percent of facility utilization was planned or anticipated (at the time this project was authorized) and actually obtained at 6 months after the end of startup?

	Planned	Obtained
	_____ %	_____ %
a. 6 months		

b. If planned utilization differed from that actually obtained, what were the main reasons for the difference? (Please check all appropriate box(es))

<u>Reason</u>	<u>Reason</u>
<input type="checkbox"/> Availability of facility	<input type="checkbox"/> Maintainability
<input type="checkbox"/> Quality	<input type="checkbox"/> Availability of users
<input type="checkbox"/> Performance	<input type="checkbox"/> Market Demand
<input type="checkbox"/> Other (please specify) _____	

2.5.3 Have there been any unanticipated renovations since substantial completion?  
(please check only one answer)

☐ No - (If no, please skip to the next question below.)

☐ Yes - (If yes, please answer the following questions, 3a, 3b, 3c).

a. What was the cost of the renovations? \$ \_\_\_\_\_

b. How long did the renovations take? \_\_\_\_\_ months

c. Why were these renovations needed? (*Please check all that apply*)

- |                          |                                |                          |                                 |
|--------------------------|--------------------------------|--------------------------|---------------------------------|
| <input type="checkbox"/> | Reason                         | <input type="checkbox"/> | Reason                          |
| <input type="checkbox"/> | Facility Function Modification | <input type="checkbox"/> | Regulatory Change               |
| <input type="checkbox"/> | Operability                    | <input type="checkbox"/> | Design Error                    |
| <input type="checkbox"/> | Maintainability                | <input type="checkbox"/> | Increase Capacity               |
| <input type="checkbox"/> | Construction Error             | <input type="checkbox"/> | Other ( <i>Please specify</i> ) |
- 

**New:**

2.5. 1 - 2.5.3 Omit

**Reason:**

Questions in this section pertain to industrial type projects.

**e. Current:**

2.7.2 We would like to know your **overall** opinion of how well the design professionals performed on this project, taking into consideration all the areas that we have just covered. On a scale of 1 to 5, with 1 being **very unsuccessful** and 5 being **very successful**, please provide us with your rating of the **overall** effort.

1 2 3 4 5

What are your main reasons for your assessment of the design professional?

---

**New:**

2.7.2 We would like to know your **overall** opinion of how well the design professionals performed on this project, taking into consideration all the areas that we have just covered. On a scale of 1 to 10, with 1 being **very unsuccessful** and 10 being **very successful**, please provide us with your rating of the **overall** effort.

1 2 3 4 5 6 7 8 9 10

What are your main reasons for your assessment of the design professional?

---

**Reason:**

Need to have more variance in the scale. Most ratings were 3 or 4.

*Service Acquisition Questionnaire*

**a. Current:**

3. Check the one statement that best describes the **timing of the cost proposal submission** by the service provider to the owner:

- ☐ Submitted as a bid, with no pre-qualification.
  - ☐ Submitted concurrently with firm's qualifications.
  - ☐ Submitted after pre-qualifying, but prior to selection.
  - ☐ Submitted after pre-qualifying, and after selection..
  - ☐ Other (Please specify)
- 

**New:**

3. Check the one statement that best describes the **timing of the cost proposal submission** by the service provider to the owner:

- ☐ Submitted as a bid, with no pre-qualification.
  - ☐ Submitted concurrently with firm's qualifications.
  - ☐ Submitted after pre-qualifying, but prior to selection.
  - ☐ Submitted after pre-qualifying, and after selection.  
but prior to contract award/negotiations.
  - ☐ Other (Please specify)
-

**Reason:**

There needs to be a distinction between contract award and selection. This is the premise that this study is based on. Does the A/E firm get selected to negotiate before the owner sees any pricing data? If the answer is yes then it is non-QBS. If the answer is no then it is QBS.

## **Chapter 6: Conclusions and Policy Implications**

### **6.1 Conclusions**

Why is it necessary to always pick the best design firm? If a firm is professionally qualified for a specific project, then is it qualified to do the job? The "Best Value" method seems to be widely used within the construction industry. This makes common sense and is the way most consumers think, whether it be choosing a service or buying a product. People will normally choose their services based on quality but within their budget. The incremental value of quality service must be equal to the incremental cost associated with paying more for that benefit. At the same time, a marginal performer just above the qualification line is not the optimum solution either.

The Brooks Act was passed over 25 years ago with the philosophy of choosing the best first and then negotiating the price with a 6 percent statutory limitation. The design costs are broken into two parts which included the initial design fees to produce the drawing and specifications and then the engineering field services. The combination of these two can easily exceed 6 percent.

It is time to take another look at the Brooks Act, and the evaluators must use statistical data to back up any decisions. There is a new era evolving in the design industry, as A/E firms from other countries are entering the US market and are able to compete quickly because they are producing the same quality of drawings for less money. That is probably one of the reasons why much of the private industry is beginning to see a shift towards "best value" engineering acquisition method.



Realizing that this is only a pilot study of eight projects and a more in-depth investigation with more projects picked at random should be conducted, the following conclusions were apparent from this limited sample:

- Half of the projects selected were non-QBS, and none were competitive low bid. However, several used price and qualification to select.
- The percentage of design cost of non-QBS projects are 20 percent less than QBS projects.
- There was no significant difference in cost per square foot between QBS and non-QBS, including design and construction cost.
- The non-QBS projects completed 26 percent more on schedule than the QBS projects.
- The QBS projects experienced less design changes than non-QBS.
- There was no direct correlation with design ranking and overall project performance.
- Both questionnaires need to be modified for future studies to focus more on design issues and to simplify the questions. Suggestions are given in this thesis.

The null hypothesis for this study is that there is no significant relationship between project performance and the method of selection of the design service provider. Only a few factors were looked at in this study and the study is inconclusive although it is intriguing at the same time. This pilot study is a good indicator of a possible change that is occurring within the private sector.

Specifically, this was noticeable by observing the results of a small sample of owners hiring A/E firms. However, there is no clear solution at this point and a solid study researching the benefits and shortfalls of A/E acquisition is warranted.

## **6.2 Policy Implications**

Why continue with business as usual when the times are quickly changing? As mentioned earlier, there have been improvements to the FAR with the Federal Streamlining Act. Also Design/Build is another example of how the design selection method is transitioning. The Government spends millions of dollars on outsourcing A/E firms. Why not take a thorough look at the Brooks Act and address the applicability of moving into the 21st Century with the current system.

The overwhelming policy implication is that there is no clear cut solution and there should not be one. One possibility is to provide a system where combination of qualifications of an A/E firm and complexity of the project should determine who is selected. As the complexity of the project increases so does the screening process for selecting an A/E firm. However, cost should always be a factor. This brings the concept back of choosing the "best value." Not only does this enhance competition, but it will be the trend in the private construction industry into the future. Hopefully, the study that was piloted in this thesis will be performed in the future and provide guidance for change.

## Appendices

## **Appendix A: Project Performance Questionnaire**

**PROJECT PERFORMANCE  
QUESTIONNAIRE**

Building Version

The University of Texas at Austin

15 Aug 96

### Project Performance Questionnaire

1.1. Organization Name: \_\_\_\_\_

1.2. Point of Contact:

1. Name: \_\_\_\_\_

2. Title: \_\_\_\_\_

3. Address: \_\_\_\_\_

4. Tel. No: \_\_\_\_\_ Fax No: \_\_\_\_\_

2.1. General Project Information:

1. Project Name: \_\_\_\_\_

(Is the above name for the project correct? If not, please correct it on the line below.)

2. In what town or city is the project located? \_\_\_\_\_

In what state? \_\_\_\_\_

3. What type of facility is this project? (Please check only one)

☐ Jail/Prison

☐ Retail

☐ School

☐ State/County/City government

☐ Office Building

☐ Other (please specify) \_\_\_\_\_

☐ Correctional Facility

☐ Maintenance Facility

4. What are the primary products or services produced by this facility? \_\_\_\_\_

5. What is the approximate size or design capacity of this facility? \_\_\_\_\_

(EXAMPLES:: gross square feet, number of beds, etc. )

6. Which of the following best describes the site on which this project was built? If more than 25% of the project was a renovation, please classify the project as a Retrofit/Expansion. (Please check only one answer)

☐ New construction

☐ Other (please describe) \_\_\_\_\_

☐ Retrofit/Expansion

7. In the table below, circle the one word (negative, none, or positive) that best represents the overall influence that factor had on the project's performance. After checking the one best word, check the box under all categories ( time, cost, quality, or other) affected by that factor. Factors left blank are assumed as not affecting the project.

"Negative" signifies the factor negatively affected the project, causing time delays, increased cost, or reduced quality. "None" signifies the factor did not affect the project, and had no influence on time, cost or quality. "Positive" signifies the factor positively affected the project, causing time acceleration, reduced costs, or increased quality.

FACTOR	Project Influence (Check only one per factor)			Categories Affected (Check all that apply)			
	Negative	None	Positive	Time	Cost	Quality	Other
<b>Externally driven factors</b>							
1. competitive const. market	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. local conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. regulations or permits	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. labor strikes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. material availability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. abnormal weather	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. unrest, insurrection, war	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. acts of god	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Owner controlled events</b>				Time	Cost	Quality	Other
9. pre-project planning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. contracting strategy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. design reviews	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. constructability prog.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. construction manager	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. time constraints	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. use of incentives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. financing or funding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. partnering	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Project specific factors</b>				Time	Cost	Quality	Other
18. remoteness of the site	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. complexity of project	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. new technology/design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. first of its kind	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. largest (scale)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. special foundation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. hazardous materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. experience	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. proclivity to claim	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. attitude	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28. safety practices	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Other (specify)</b>				Time	Cost	Quality	Other.
29.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

*EXPLANATION: (If you indicated that any of these factors affected the project, please indicate it by number and briefly explain below. Use the back of the page if necessary):*

8. Please identify the prime design firm:

Name of Firm: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Primary Contact: \_\_\_\_\_  
 Title: \_\_\_\_\_  
 Tel. No: \_\_\_\_\_ Fax No: \_\_\_\_\_

2.2. Cost Information:

1. What was the capital cost breakdown, by the following major cost categories, for the estimated cost at the time of major funding authorization and the actual final cost of the project? In order to assist you in completing this section, guidelines for selected cost categories follows:

*Owner Costs: The direct owner incurred costs, excluding procured equipment or any subcontracts.*

*Owner Procured Equipment/Materials: The costs associated with owner procurement of any equipment or materials inclusive of any capitalized subcontract costs (i.e., procurement by a subcontractor on an owner's purchase order).*

Total Project Cost	Estimated Cost *	Actual Cost
Owner Costs		
Owner Procured Equipment/Material		
Engineering & Design Services		
Construction Contractor Equip, Material & Labor		
Commissioning, Turnover, & Startup		
Contingency		XXXXXXXXXX XX
Other		
<b>Total Project Cost</b>		

\* at Authorization/Appropriation

2. In terms of construction bidding, what were the:

Number of bidders:	
Low bid:	
Second low bid:	
High bid:	

**OR**

*attach the construction bid list for the project*



2.3. Schedule Information:

1. What was the date of major funding authorization? \_\_\_\_\_
2. What was the planned duration of the execution schedule (from project authorization to substantial completion) at project authorization (in months)? \_\_\_\_\_ months.
3. What was the actual date of substantial completion? \_\_\_\_\_
4. If there were any **schedule overruns** greater than 1 percent of total project duration, please indicate the reason(s) in the appropriate box(es) below by supplying the duration(s) of the change(s) *(Please check all that apply.)*

<u>Delay</u>	<u>Weeks.</u>	<u>Delay</u>	<u>Weeks.</u>
<input type="checkbox"/> Scope/Design Change	_____	<input type="checkbox"/> Funding Change	_____
<input type="checkbox"/> Labor Shortage	_____	<input type="checkbox"/> Regulatory Change	_____
<input type="checkbox"/> Contract Dispute	_____	<input type="checkbox"/> Equipment Availability	_____
<input type="checkbox"/> Weather	_____	<input type="checkbox"/> Construction Productivity	_____
<input type="checkbox"/> Strike	_____	<input type="checkbox"/> Engineering Productivity	_____
<input type="checkbox"/> Material Shortage / Delivery	_____	<input type="checkbox"/> Other <i>(please specify)</i>	_____

5. If you checked "Scope/Design Change" in 4., above, please describe the change(s)  
\_\_\_\_\_

2.4 Change Information:

1. What was the total approximate number of change orders issued *(including engineering and construction)*? \_\_\_\_\_
2. What was the total dollar amount of all change orders?  
\$ \_\_\_\_\_  
*(approximate, if necessary).*
3. What was the net change in the completion date resulting from change orders?  
\_\_\_\_\_ months  
Did the net impact of the changes increase or decrease the length of the original project duration? *(Please check only one answer)*  
☐ Increase    ☐ Decrease    ☐ No change in project duration
4. Were there any individual changes after project authorization that exceeded 1 percent of the project budget? *(Please check only one answer)*  
☐ No  
☐ Yes - *(If "Yes", what were the total cumulative effects and the direction of these changes on):*

- a. Cost - \$ \_\_\_\_\_ [ ] Increase or [ ] Decrease  
 b. Schedule - \_\_\_\_\_ months [ ] Increase or [ ] Decrease  
 c. How many changes were 1 percent of the original project budget or greater?  
 \_\_\_\_\_  
 d. What were the reasons for the changes? (Please check all that apply)

<u>Reason</u>	<u>Amount</u> (%)	<u>Reason</u>	<u>Amount(%)</u>
User Change	_____	Funding Change	_____
Schedule Change	_____	Regulatory Change	_____
Weather	_____	Strike	_____
Differing Site Conditions	_____	Design Error	_____
Estimating Error	_____	Market Change	_____
Scope & Design Changes	_____	Other (Please specify)	_____

2.5. Operating Information:

1. What percent of design capacity (usable space, or capacity) was planned or anticipated at the time this project was authorized and actually obtained 6 months after substantial completion?

	Planned	Obtained
a. 6 months	_____ %	_____ %

2. What percent of facility utilization was planned or anticipated (at the time this project was authorized) and actually obtained at 6 months after the end of startup?

	Planned	Obtained
a. 6 months	_____ %	_____ %

- b. If the planned utilization differed from that actually obtained, what were the main reasons for the difference? (Please check all appropriate box(es))

<u>Reason</u>	<u>Reason</u>
[ ] Availability of facility	[ ] Maintainability
[ ] Quality	[ ] Availability of users
[ ] Performance	[ ] Market demand
[ ] Other (please specify) _____	

3. Have there been any unanticipated renovations since substantial completion? (please check only one answer)

☐ No - (If no, please skip to the next question below.)

☐ Yes - (If yes, please answer the following questions, 3a, 3b, 3c).

a. What was the cost of the renovations? \$ \_\_\_\_\_

b. How long did the renovations take? \_\_\_\_\_ months

c. Why were these renovations needed? (Please check all that apply)

Reason

☐ Facility Function  
Modification

☐ Operability

☐ Maintainability

☐ Construction Error

☐ Improve Efficiency

Reason

☐ Regulatory Change

☐ Design Error

☐ Increase Capacity

☐ Other (Please specify)

\_\_\_\_\_

2.6 Other Information

1. Did the project have any claims that required arbitration, litigation, or mediation?

☐ No - (If no, please skip to the next question below.)

☐ Yes - (If yes, please answer the following question, 1a).

a. If so, please indicate the magnitude and provide details.

\_\_\_\_\_

2. Were there any protests regarding selection of A/E's?

☐ No - (If no, please skip to the next question below.)

☐ Yes - (If yes, please answer the following question, 2a).

a. If so, please elaborate?

## 2.7 Subjective Evaluation of the Project

1. The following questions are intended to subjectively evaluate the facility. (*Read the statement about the project, then provide a response to the statement on a scale of 1 to 5, with 1 meaning you strongly disagree with the statement, 3 meaning you neither agree or disagree and 5 meaning you strongly agree with the statement. DK stands for "Don't Know".*)

- |    |  |   |   |   |   |   |    |
|----|--|---|---|---|---|---|----|
| a. | In general, project participants worked well together.   | 1 | 2 | 3 | 4 | 5 | DK |
|    | <i>Examples of project participants are owners, customers, design contractors, and consultants. The participants worked together toward the common goal of successfully designing the project.</i> |   |   |   |   |   |    |
| b. | Emphasis was placed on identifying and satisfying the needs of the customer by the design professional(s).   | 1 | 2 | 3 | 4 | 5 | DK |
| c. | This project was characterized by high quality, professional performance by project participants.  | 1 | 2 | 3 | 4 | 5 | DK |
| d. | Innovative design solutions were used to solve project problems and provide a state-of-the-art facility  | 1 | 2 | 3 | 4 | 5 | DK |
| e. | Lessons learned from previous construction projects were incorporated into this project during the design phase.   | 1 | 2 | 3 | 4 | 5 | DK |
| f. | The facility design is aesthetically pleasing.   | 1 | 2 | 3 | 4 | 5 | DK |
| g. | The goals to maintain or improve the quality of the environment were met or exceeded by this project. ( <i>Goals should include organization and/or regulatory</i> )                               | 1 | 2 | 3 | 4 | 5 | DK |
| h. | The completed facility has provided a safe workplace since it was placed into operations.  | 1 | 2 | 3 | 4 | 5 | DK |
| i. | The goals concerning ease of facility operation were met or exceeded. ( <i>Examples of ease of operation goals are operating staff size and overtime.</i> )  | 1 | 2 | 3 | 4 | 5 | DK |
| j. | This project met or exceeded its goals concerning the number of days it was available for operation in a year.   | 1 | 2 | 3 | 4 | 5 | DK |
| k. | There has been little need for any major, unplanned facility improvements or changes since completion of this project.   | 1 | 2 | 3 | 4 | 5 | DK |
| l. | The goals concerning the ease of maintenance were achieved by the execution of this project.   | 1 | 2 | 3 | 4 | 5 | DK |
| m. | The experience of the design professional was adequate to perform the design of this project.  | 1 | 2 | 3 | 4 | 5 | DK |
| n. | The design professional fostered an effective level of communications during the course of the design  | 1 | 2 | 3 | 4 | 5 | DK |

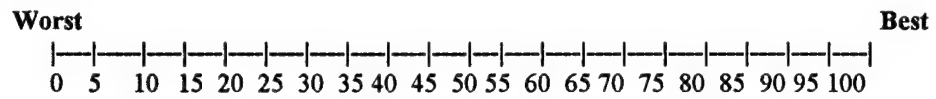
2. We would like to know your overall opinion of how well the design professionals performed on this project, taking into consideration all the areas that we have just covered. On a scale of 1 to 5, with 1 being very unsuccessful and 5 being very successful, please provide us with your rating of the overall effort.

1   2   3   4   5

What are your main reasons for your assessment of the design professional?

---

3. In ranking this project's success against all projects you are familiar with, in what percentile would you place this project? *(Circle, or "x" the appropriate percentile on the scale below.)*



## **Appendix B: Service Acquisition Questionnaire**

**SERVICE ACQUISITION  
QUESTIONNAIRE**

The University of Texas at Austin

## Project Questionnaire

1.1. Project Name:

Prime Design Firm: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Primary Contact: \_\_\_\_\_

Title: \_\_\_\_\_

Tel. No: \_\_\_\_\_ Fax No: \_\_\_\_\_

2.1 Service Provider Selection Factors

1. Check the one statement that best describes the service provider's fee for this project:

- ☐ Fixed price.
- ☐ Reimbursable costs with fixed profit.
- ☐ Reimbursable costs with guaranteed maximum price.
- ☐ Reimbursable costs plus incentive payment.
- ☐ Multiple of Hourly Rate(s).
- ☐ Percent of Construction.
- ☐ Cost plus % of Cost
- ☐ Other (Please

specify \_\_\_\_\_

2. Check the one statement that best describes the degree of cost negotiation pressure by the owner on the service provider:

- ☐ None      ☐ Some      ☐ Intense      ☐ Inflexible

3. Check the one statement that best describes the timing of the cost proposal submission by the service provider to the owner:

- ☐ Submitted as a bid, with no pre-qualification.
- ☐ Submitted concurrently with firm's qualifications.
- ☐ Submitted after pre-qualifying, but prior to selection.
- ☐ Submitted after pre-qualifying, and after selection..
- ☐ Other (Please specify)

\_\_\_\_\_



4. Check the one statement that best describes the **format of the cost proposal**:

☐ Lump sum.

☐ Hourly Rates plus multiplier.

☐ Hours (not dollars) provided.

☐ Other (Please specify)

---

	<u>Pre—qualified?</u>	
<input type="checkbox"/> Sole source	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<input type="checkbox"/> 2 or 3 competitors	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<input type="checkbox"/> 4 or 5 competitors.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<input type="checkbox"/> 6 + competitors	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<input type="checkbox"/> Other (Please specify)		

☐ No pre-qualification required.  
☐ by owner's invitation only.  
☐ open to any interested firm.  
☐ Other (Please specify)

Importance:	Not	somewhat		Very	
[ ] Technical expertise in this type project.	1	2	3	4	5
[ ] Technical expertise in similar type projects.	1	2	3	4	5
[ ] Experience in this type of project	1	2	3	4	5
[ ] Experience in similar types of projects	1	2	3	4	5
[ ] Immediate availability to begin this project.	1	2	3	4	5
[ ] Other (specify) _____	1	2	3	4	5

☐ Qualifications      ☐ Cost      ☐ Don't Know      ☐ Other  
(specify)

## Bibliography

- Angelo, William J. (1995). *Procurement: AE Selection on Public Jobs Faulted in Massachusetts*, ENR, 27 Nov 95.
- Architectural Record (1994). Editorial: *It's No time to Scuttle Brooks Act*, Mar 94.
- Architectural Record (1994). Editorial: *What's an Architect Worth?*, Mar 94.
- Babbie, E. (1990). *Survey Research Methods*, 2nd Ed., Wadsworth Publishing Co., Belmont California.
- Bell, Landsford C., Gibson, George E. Jr. (1990). *Data Integration Strategies in Construction*. Report to Construction 1989 Industry Institute: The University of Texas at Austin.
- Brooks Act (1992). *Subchapter VI Selection of Architects and Engineers Senate Report*. Title 10 section 2855. DeFraithe, Author A. Jr. (1989). *Fee Versus Quality*, Journal of Professional issues in Engineering, Vol. 115, No. 2, American Society of Civil Engineers (ASCE).
- Construction Industry Institute References (1986-1994)
- a. SD-102 Perceptions of Representatives Concerning Project Success and Pre-Project Planning Effort (Sep 94)
  - b. SD-105 Analysis of Pre-Project Planning Effort and Success Variables for Capital Facility Projects (Nov 94)
  - c. SP 43-1 Project Change Management (Nov 94)
  - d. Pub. 43-2 Quantitative Effects of Project Change (Dec 94)
  - e. SP-3 Constructability Concepts (Aug 87)
  - f. SP 34-1 Constructability Implementation Guide (May 93)
  - g. Pub 24-1 Cost-Trust Relationship (Nov 93)
  - h. Pub 5-2 Incentive Plans: Design & Application Considerations (Nov 88)
  - i. Pub8-1 Evaluation of Design Effectiveness (Jul 86)

- j. Pub. 8-2 Input Variables Impacting Design Effectiveness (Jul 87)
- k. Pub. 7-1 Cost & Benefits of Materials Management Systems (Nov 86)
- l. SP 17-1 In Search of Partnering Excellence (Jul 91)
- m. SP 12-2 Organizing for Project Success (Feb 91)
- n. Pub. 39-1 Pre-Project Planning: Beginning a Project the Right Way (Dec 94)
- o. Pub. 12-1 Projective Objective Setting (Apr 89)
- p. Pub. 10-1 Costs of Quality Deviations in Design and Construction (Jan 89)

ENR (1991). Author not Identified, Procurement: Ohio Designers Fighting Price-Based Selection, ENR 7 Oct 91. *Federal Acquisition Regulations (FAR) Part 6 - Competition Requirements*, US Government Printing Office.

Federal Acquisition Regulations (FAR) Far 36.6 - *Architectural-Engineering Services*, US Government Printing Office.

Federal Legislative Priorities - Public Policy Bulletin (1996). AIA (American Institute of Architects).

General Service Administration (GSA) (1994). *The Design Excellence Program*. Draft Copy, GSA Public Building Service, Washington, D.C., April 28.

Grogan, Tom (1995). *International: US Lowest in Design Fees*, ENR, 27 Mar 95.

Hampton, Delon (1994). *Procurement Issues*, Journal of Management in Engineering, Vol 10, No. 6, American Society of Civil Engineers (ASCE).

Hatheway, Allen W. (1995) *Forum: End the Evils of Bid Competition*, Civil Engineering, Nov 95 American Society of Civil Engineers (ASCE).

Ichniowski, Tom; Winston, Sherie; Angelothe, William J. (1995). ENR Washington Observer, *Brooks Act May Cover Defense*, ENR, 27 Nov 95.

Knoke, David; Bohrnstedt George W. (1982). *Statistics for Social Data Analysis*, 3<sup>rd</sup> Ed., F.E. Peacock Publishers, Inc., Itaska, Illinois.

- Korman, Richard; Kohn, David (1995). *Cover Story: When Price Is Paramount*, ENR, 3 July 95.
- Lunch, Milton F. (1994). *Legal Trends: Legislation Seeks Two-Phase Design-Build for Federal Agencies*, Building Design & Construction, Sep 94.
- Lunch, Milton F. (1991). *Legal Trends: Public Design/Build Nixed in Texas, Florida*, Building Design & Construction, Jun 91.
- Massachusetts Taxpayer's Foundation (1995). *Taxpayer's Look at a Sacred Cow: Public Sector Design in Massachusetts Two Decades After the Ward Commission*, Massachusetts Taxpayer's Foundation, Boston Massachusetts.
- M.R. Mikkilineni v. United Engineers & Contractors, inc.*, 485 Federal Supplement 1292, pages 1292-1299.
- NAVFACCONTRACEN (1996). *Architect-Engineer Contracting Student Guide*. Naval Facilities Contract Training Center, Port Hueneme, CA.
- NAVFACENGCOM (). *A Plan to Improve the A/E Hiring Process*. Naval Facilities Engineering Command, August 1.
- NAVFACENGCOM (1994). *Policy and Procedures for the Newport Design/Build (D/B) Process*, Draft Copy, Naval Facilities Engineering Command, February 28.
- PSMJ (1996). *1996 Design Services Fee Survey*, PSMJ Resources, Inc., Practice Management Associates, Ltd., Newton, Massachusetts.
- Public Buildings (1992). *Selection of Architect and Engineers Senate Report 92-1219*, October 14.
- Roth Michael B. (1995). *An Empirical Analysis of United States Navy Design/Build Contract*. Thesis, The University of Texas at Austin.
- Schriener, Judy (1995). *Design: High Overhead Lower Cost*, ENR, 3 July 95.
- USCA 40 Subchapter VI, 541 through 544, *Selection of Architects and Engineers*.

Vanden Bosch, Jon; Mouer, Simon R. III; Gibson, G. Edward Jr.; O'Connor, James T. (1996). *Plan for Research into Architectural/Engineering Service Selection Method*, Department of Civil Engineering, The University of Texas of Austin.

*B-201395.2*, Contracts-Architect, Engineering, etc. Brooks Bill Applicability: Matter of Association of Soil and Foundation Engineers, Reconsideration, 6 May 1982, Decisions of the Comptroller General.

*B-218404.2*, *B-218474*, Contract-Small Business Concerns-Award; Matter of Richard Sanchez Associates, Decisions of the Comptroller General.

## Vita

Gregory A. Garcia was born in Grants, New Mexico on January 26, 1962, the son of Ramona and Alfred Gregory Garcia. After completing his work at Alamogordo High School, Alamogordo, New Mexico, in 1980, he entered the Naval Academy Preparatory School in Newport, Rhode Island and graduated in May 1981. He then entered the United States Naval Academy in Annapolis, Maryland on 6 July 1981. He received the Degree of Bachelor of Science in Systems Engineering from the United States Naval Academy and was commissioned as an Ensign in the United States Navy on May 22, 1985. He was promoted to Lieutenant Commander on 1 September 1995. His tours of duty within the United States Navy have included assignments as a Division Officer on board the *USS MOINESTER (FF1097)*, Antisubmarine Warfare Instructor, Resident Officer in Charge of Construction, and as Company Commander and Officer in Charge of Air Detachment in the Naval Mobile Construction Force.

In January, 1996, he entered The Graduate School at The University of Texas

Permanent Address: 1005 Scenic Drive  
Alamogordo, NM 88310

This Thesis was Typed by the Author.